Neural and Vascular Manipulation in the Context of Structural Integration

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Abstract

In recent years, neural manipulation methods, pioneered by Jean-Pierre Barral, DO and Alain Croibier, DO, have been used increasingly by Structural Integrators to further the goals of Structural Integration. Yet, there is another set of methods developed by these same two osteopaths that could be of great additional value to Structural Integrators. Blood vessels, principally arteries, play a role in structure equal to nerves; Barral and Croibier have published multiple works on this subject (2000, 2007, 2008), however these publications deal much more extensively with nerves than with arteries. This publication pattern likely accounts for the greater awareness of neural manipulation in the therapeutic community. This article is a step to bring awareness of neural and vascular manipulation into balance. The importance of both types of manipulation and interrelationships between them are presented. Cautions for neurovascular manipulation are offered.

Introduction

It is the experience of many Structural Integrators that releasing adhesions and contractures associated with nerves is a valuable adjunct to other methods used in Structural Integration. Nerves often run along and through planes of fascia, so as we differentiate fascial planes and release tight fascial sheets, we are often releasing fascial restriction around the peripheral nerves. Now that many of us have begun practicing neural manipulation, we recognize that some of what we thought we were accomplishing structurally by working with the myofascia actually was facilitated by the inadvertent treatment of nerves associated with the myofascia. Similarly, many of us have discovered that the pain typically associated with classic SI techniques can often be avoided if the nerves are sensitively attended. Refining our awareness of nerves within their surrounding tissues and modifying our fascial manipulation techniques so that we are working more specifically to free and mobilize the nerves often leads to superior results. However, a related and vital additional avenue of approach in fascial manipulation is still relatively unexplored by most Structural Integrators; vascular manipulation bears a promise of improved precision and effectiveness for the practitioner who learns to identify vascular restrictions and then gently and specifically improve the elasticity of these blood vessels and their associated connective tissue.

Grisly Experiments Lead to More Humane Clinical Studies

The importance of nerves and blood vessels for structure in injured tissue came to light in a pair of studies conducted in France (Verriest J, et al, 1986; Balas, Ramet, 1988). These studies reported aspects of research conducted by the French Transportation Security Administration. The mandate of this administration is to improve safety in transportation including on the highways. One facet of this work is testing and review of automotive passenger restraint systems. To this end a test track was constructed on which a vehicle could be accelerated up to 100 kmph and then run into a wall. Various combinations of seats, restraint systems, and speeds were tested using this track. The initial test subjects were fresh human cadavers, which were examined before and autopsied after the crashes. Expected injuries, including ribs broken by shoulder harnesses and brain shearing, were observed. In addition the autopsies showed extensive damage to nerves and blood vessels, principally arteries. While these tests were informative, the test subjects had limitations, as they were not living, usually geriatric, and tended to have underlying pathologies that led to their being not living. Looking into other possible test subjects, the researchers learned that human torsos are most like the torsos of pigs than any other animal. The researchers then strapped anesthetized pigs into the test vehicles. Some of the pigs were killed outright in the crashes and were promptly autopsied showing results quite similar to the cadavers. Other pigs survived and were allowed to heal for a period of months before they were sacrificed and autopsied. In these pigs that had healed for months, extensive fibrosis was seen associated with the injured nerves and blood vessels. Use of animal subjects in this way was banned in France soon after these studies were conducted. Osteopaths Barral and Croibier read these studies and realized it would be useful to develop methods to treat fibrosed nerves and blood vessels (personal communication, Croibier A, 2005). The methods they created for this purpose are a major advance in manual therapy. Barral and Croibier have published three books related to this line of therapeutic development (2000, 2007, 2008).

Fibrosis Following Injury Impedes Glide

Blood vessels and nerves must glide through tissue to allow normal movement. French hand surgeon J.F. Guimberteau has done extensive *in vivo* work with endoscopes, followed by theoretical modeling to show the glide of tendons and blood vessels. This is beautifully visualized in his CD titled *Strolling Under The Skin*, 2003.

We think of nerves as very long multinucleate cells that carry information. Most of these individual nerve cells are of such small diameter we cannot see them with the naked eye. Macroscopic nerves, which we can see with our eyes and feel with our fingers, are made up of a great number of long neurons bundled together with connective tissue as insulation and structural support. The composition of each macroscopically observable nerve is 50 - 90% connective tissue. As with any other connective tissue, the fiber content, elasticity, and span of the neurofascia can change.

Connective tissue contains several types of fiber that differ in elasticity. Each type of connective tissue—cartilage, tendon, fascia, loose areolar tissue, etc.—has a characteristic total quantity of fiber, with proportions of elastic and less-elastic fiber unique to that tissue. All connective tissue types, when injured, respond with fibroblast activity producing the least elastic types of fiber to knit the tissue back together. This leads to a substantial reduction in the elasticity of the now repaired tissue. In addition, the rapid and continuing growth of inelastic fiber tends to produce adhesions to adjacent structures, reducing or eliminating glide between structures. As the healing process continues, eventually the body re-absorbs part of the excess fiber produced, however the resulting healed and remodeled tissue usually remains less elastic than it was before injury, and residual adhesions are quite common. This general plan for healing applies to any connective tissue, including the connective tissue associated with nerves and blood vessels.

Reduced Glide and Elasticity of Nerves Affects Posture and Overall Structure

As mentioned, nerves and blood vessels normally glide through tissue to accommodate movement. An example of how lack of neural glide can significantly affect structure is provided by the phrenic nerve. The phrenic nerve supplies the large central portion of the respiratory diaphragm. It also penetrates the diaphragm to serve the digestive organs, redundant with other innervation. In any whiplash-like event, the central trunk of the phrenic nerve and any of its branches are easily injured, since the phrenic nerve originates from nerve roots C3-C5 and runs inferiorly along the anterior scalene into the thorax. As the injured nerve branches heal, they lose elasticity and glide. Tension and lack of elasticity in the connective tissue elements of the nerve will generate a head-forward posture and shortening through the front of the torso. This is because when the nerve has lost stretch and glide, it is more vulnerable to tearing in future posterior accelerations of the head, therefore the body will protectively make postural accommodations to give the nerve slack. Muscular effort to maintain this postural compensation and to protect the nerve leads to pain, and myofascial shortening over time further reduces mobility. If a Structural Integrator attempts to correct a head-forward posture in someone whose phrenic nerve was previously injured and is now fibrosed, attempts to release fascia in the torso and neck to bring the head back in line over the torso may yield disappointing results. In contrast, if the phrenic nerve is gently and precisely freed using long lever methods, the related muscles and associated connective tissue will often relax without being treated directly. Additional work on organ support membranes, such as the pleura and walls of the mediastinum, and on the dura may also be necessary.

The greater occipital nerve, arising from the C2 nerve root, provides us with another example of how neural restriction can affect head position. Unlike many spinal nerves, which initially course inferiolateral, the greater occipital nerve initially runs superiorly to the occiput. From there it spreads out like the branches of a tree onto the back of the head, up to about the coronal suture. Branching more often remains ipsilateral, but may cross the midline. Branches of this nerve innervate skin and (if they carry tension) create characteristic dimpling of the skin, which allows us to identify the branches with tension. If the primary trunk of the greater occipitial nerve, running superior from the C1-C2 vertebral interspace onto the occiput, has reduced elasticity and/or is adhesed to adjacent tissue this will sharply limit flexion at the atlanto-occipital joints, at least unilaterally. Mobility of C1 on C2 will also be reduced. Again gently and precisely restoring the stretch and glide of this nerve will improve upper cervical mobility and head position and reduce associated head pain.

Neural manipulation can also be used to normalize tone and improve stretch in certain muscles, thereby changing posture and function. For example, the gluteal nerves, which arise from L4, L5, and S1 roots and terminate in the gluteal muscles and tensor fascia lata muscle, can be manipulated to free up hip movement. Span of the left gluteus maximus muscle can be tested by having the client supine on a table with the Structural Integrator at the client's left side. The client's left leg is lifted with the left hand under the calf, while the left ilium is stabilized with the right hand. The leg is then moved into flexion, internal rotation, and adduction, taking it toward the ceiling and across the body. If the muscle appears tight, it can be returned to the table and hand positions shifted so the now seated Structural Integrator places the fingers of the left hand under the gluteus maximus muscle and the tips of the right fingers relatedly on the spinous processes of L4, L5, and S1. The left hand is then used to traction the gluteus maximus muscle inferiolaterally along the direction of its fibers toward the greater trochanter. If one of the three spinous processes of the spinal segments from which the gluteal nerve arises is felt to move laterally in response to this pull, a tight nerve root from this level is suspected. To confirm this the spinous process in gently moved with the hand a few millimeters in the direction of the observed displacement. If this produces apparent lengthening of the gluteus maximus m. a tight nerve root from that spinal level is likely. If the spinous process is then gently moved in opposition to its movement in response to the pull on the muscle, and if the muscles now seems tighter than before this adds further evidence to the existence of a tight nerve root from that level into the gluteal nerve innervating the gluteus maximus muscle. The elasticity of this nerve can be restored by using the spinous process of interest and the belly of the gluteus maximus muscle as 'handles' to very gently stretch and glide the nerve. The span of the muscle should then be post-tested in the same fashion as initially done to observe the result of the intervention. A similar plan can be applied to any muscle.

Assessing Restriction and Fascial Adhesion of Blood Vessels Prepares the Way for More Effective Intervention

Nerves and blood vessels usually travel together through the body. Classically there is a triplet of nerve, artery, and blood vessel traveling in close proximity. An example is each intercostal artery, nerve, and vein coursing between each rib pair. Another example is the subclavian artery and vein and portions of the brachial plexus. An interesting example is the carotid artery and jugular vein that are accompanied by not one but two nerves—the phrenic and vagus nerves. There are also exceptions; for example, at the wrist the radial vessels are on the palmar aspect of the wrist, while the radial nerve is a couple of centimeters away on the thenar/lateral aspect of the radius. In other areas, questions of common course arise. For example, the aorta does not quite have the same relationships to specific nerves as do other arteries; for nerves corresponding to the aorta, we can consider the autonomic chain along the front of the spine, or even the spinal cord, which lies closely parallel but in another compartment, across the bony frontier of the vertebral bodies.

In the typical triplet of artery, vein, and nerve, any of these elements and/or their accompanying loose areolar and other connective tissue can be injured and subsequently fibrosed. The least likely element to be injured is the vein. Since veins are the low-pressure side of the circulatory system, their walls are more elastic than arteries. Like an oak and a willow standing next to each other in a hurricane, veins are much less likely to be injured in impact and extreme stretch injuries. However, veins can be injured by crush injuries and by chemotherapy. Veins may also have adhesions resulting not so much from injury to the vein as from inflammation of adjacent tissue, resulting in the inclusion of a vein in an adhesion originating outside the vein.

In each situation, it is very valuable to discriminate exactly which element or elements of the triplet are fibrosed, so that therapeutic intervention can be applied in the most precise, and therefore effective and economical way. This discrimination can be accomplished with differential mobility testing. Above, a method was described for assessing tension in nerves running from the spine to muscles. Tight arteries to muscles will similarly make the muscle appear tight. A tight artery to skin can stiffen it, having a surprisingly large impact on mobility and alignment. Vascular elasticity and glide can be assessed by a method similar to the one described for nerves. Arteries can be palpated and distinguished by the obvious pulse in them. Veins usually lie adjacent to arteries, do not demonstrate palpable pulse, and have a characteristic 'flat tire' feeling. Starting at any distance upstream (toward the heart) in the vascular tree, tension can be tested to the muscle, organ, bone, or other structure of interest.

As an example of a common and important arterial restriction, the vertebral arteries must glide through the apertures in the lateral aspects of the cervical vertebrae. Vertebral arteries are easily injured in any event that accelerates the head too quickly. This can happen in a car accident, a boxing match, or many other sporting events, in a fall, or even being jostled hard in a crowd. This vulnerability is a cost of our having a large brain on the end of a narrow stalk. Pigs are much less vulnerable to this injury than we are, and it simply can't happen to Dolphins, who have not only thick necks but also naturally fused cervical vertebrae. If a vertebral artery is fibrosed following injury, it will not be able to stretch as much, slowing and limiting cervical movement. Adhesions of the vertebral arteries to cervical vertebrae are common and significantly reduce and distort cervical movement—for more on this, see Barral, Croibier, 2000. When vertebral arteries are fibrosed and adhesed, they are much more vulnerable to tearing in future rapid accelerations of the head. A ruptured vertebral artery is a very serious event. When a vertebral artery is adhesed, our nervous systems seem to recognize this vulnerability and will engage musculature to protect the artery, resulting in stiffness and pain. When we see neck muscles that are difficult to release and which won't stay released, adhesion of the vertebral artery is a frequent culprit. Working precisely and gently it is possible to restore the elasticity and glide of vertebral arteries. Tension in protective muscles will then promptly fade.

Another example is in the hand. Two arteries serve each hand, the radial and ulnar arteries. Within the hand there are three anastomoses or bridges between these two blood supplies, two just beyond the wrist (one deep and one superficial) and a third anastomosis distal in the palm. The radial artery and the ulnar artery can be contacted at the wrist and gently tested for stretch and glide. Each one can then be tested with respect to various parts of the hand to trace out lines of arterial restriction.

The geographic proximity of nerves and blood vessels has been mentioned. There are also extensive interconnections. Nerves have a very high metabolic rate and are extremely vulnerable to deoxygenation. Therefore there is extensive blood supply to nerves. Similarly there is innervation of the blood vessels, principally autonomic. In some cases these interconnections are of central interest. As an example, it is possible to assess the contribution to apparently tight hamstrings of tension in the sciatic nerve and of arterial supply to the sciatic nerve. To do this, have the client supine. Similar to the method described for the gluteal nerves above, stand at the side of the client. With one hand stabilize the ilium, with the other hand lift the leg to passively flex the hip. Test to a firm end point. Return the leg to lying on the table. Compare with the other leg and with sense memory of previous clients. Next, slide a hand under the upper thigh toward the medial end of the gluteal fold and just lateral to the ischial tuberosity. Sink the fingertips gently anteriorly into the tissue to feel the large cord of the sciatic nerve. Gently attempt to traction the sciatic nerve inferiorly. Compare with the other leg and with sense memory of past clients tested to gauge the stretch and glide of the sciatic nerve. Then place the other hand near the umbilicus and sink gently in to find the pulse of the aorta. Gently traction the aortic bifurcation superiolaterally, sequentially left and then right, to assess the stretch and glide of the iliac artery system. On the side of interest, take the aortic bifurcation inferiolateral toward the leg being tested; maintain the aorta in this position while again tractioning the sciatic nerve. If the sciatic nerve now feels more mobile than before, there is tension in the branch of the internal iliac artery supplying the sciatic nerve. If moving the inferior aorta superiorly and contralaterally to the leg being tested renders the sciatic nerve even less mobile, this adds further evidence for a tight artery to the sciatic nerve. Arteries usually respond well to treatment by very gently stretching.

However, stretching an artery too strongly will elicit powerful defensive activity from the body, resulting in a lack of positive therapeutic result. Too vigorous handling of blood vessels and nerves easily creates injury. Therefore always err on the side of lower force and caution. After gentle stretching between the bifurcation of the aorta and the sciatic nerve, perform post tests by first gently tractioning the sciatic nerve alone, and the nerve and artery together, as before, and then while stabilizing the ilium lift the leg to assess apparent hamstring length. If the leg can now be lifted to a greater angle and/or with less effort, the assessment of vascular contribution to apparent neural tension was correct, and the intervention successful.

Summary

Blood vessel fibrosis makes a contribution to structural disorganization equal to that of neural fibrosis. In addition, each one may affect the other. Working with any one element alone will leave aside more than half the potential benefit of working with this complex. For optimum results, all elements of a neurovascular complex—artery, vein, nerve, and associated connective tissue—must be assessed together in order to determine the most efficacious intervention for improving the organization of the whole system.

CAUTIONS

This article has described elements of a mobility testing approach to determining which element or elements of a neurovascular bundle to best treat at any given moment. Mobility testing however is not sufficient. Classical Structural Integration training uses visual inspection of body contour as a primary assessment method, and a ten- to twelve-session protocol for treating the body in a certain order is taught. Visual assessment and the ten- to twelve-session protocol work fairly well when addressing the body through the superficial fascia and myofascia. When the nerves, vasculature, dura, and viscera are included, visual inspection and the classical recipe are no longer adequate guides to sequence of intervention. When working with these additional tissues, it is essential to add osteopathic general listening as a primary guide to order of intervention. Not using osteopathic general listening when these tissues are included in treatment will be less effective at best and may make clients much more symptomatic.

Methods for working with nerves and blood vessels have been described in this article to give the reader unfamiliar with working with these vulnerable and reactive tissues a flavor of how this work is done. The qualities of touch to safely and effectively treat neurovascular structures can only be learned one-on-one with a competent instructor. Incorrect pressure and speed will result in poor therapeutic results, injury, or both.

Specific cautions relate to pathologies. Working on recently injured nerves and blood vessels is contraindicated; wait until healing has occurred. This type of work is valuable for chronic conditions, not acute conditions. Vascular fragility of any type is a contraindicaton, including hemophilia and Ellers-Danlos Type 4.

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